Generic Brownfields Quality Assurance Project Plan (QAPP)

Brownfields Assessment Demonstration Pilot
South Troy Brownfields, New York

Prepared By: U.S. EPA Region 2

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The attached U.S. EPA Region 2 Generic Brownfields Quality Assurance Project Plan (QAPP) boilerplate has been submitted in compliance with the provisions of the South Troy Brownfields Assessment Demonstration Pilot Cooperative Agreement No. BP982367-01.

The undersigned agrees to use this Generic Brownfields QAPP boilerplate to prepare site-specific Sampling, Analysis, and Monitoring Plans (SAMPs) for remedial pilot projects funded under the U.S. EPA Region 2 Brownfields Economic Re-development Initiative. The undersigned also agrees to incorporate any comments provided by their governing state environmental regulatory authorities (NYSDEC or NJDEP) concerning the development of site-specific SAMPs.

Municipal Brownfields Pilot Project Manager Concurrence:
Signature

Printed Name/Date

U.S. EPA Region 2 Project Manager Approval:
Signature

U.S.EPA Region 2
Generic Brownfields Quality Assurance Project Plan (QAPP)

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B.0 Project Organization and Responsibilities

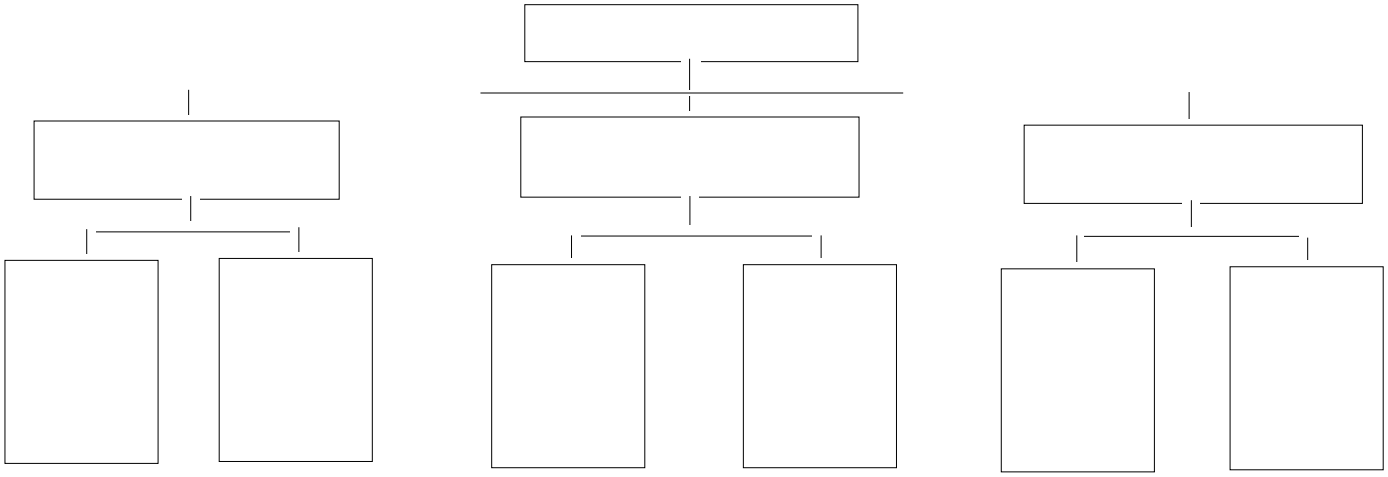
When conducting a Brownfields site investigation, many essential personnel and/or organizations are necessary to perform the remedial activities that are required. For these activities to proceed in a correct and cost effective manner, it is integral to identify all of the key individuals who will be participating in performing a site investigation project along with their responsibilities. The Project Organization and Responsibility Section of the Site-Specific Brownfields Sampling, Analysis, and Monitoring Plan (SAMP) must, at a minimum, identify the key individuals responsible for:

- Overall project coordination.
- Overall QA.
- Systems auditing (on-site evaluations).
- Performance auditing.
- Sampling operations.
- Sampling QC.
- Laboratory analyses.
- Laboratory QC.
- Data processing activities.
- Data processing QC.
- Data quality review.

To assist in the coordination of a Brownfields site investigation, it is useful to form an outline of how the key individuals responsible for performing integral tasks relate to the overall organization of the project. As a result, an organizational chart is a convenient way of illustrating the principal infrastructure of a Brownfields site investigation project. In addition, it is important to note that certain key individuals may be responsible for more than one of the aforementioned project functions.

B.1 Organizational Chart

In this section of the Site-Specific Brownfields SAMP, develop an organizational chart that identifies the chain of command for key personnel, including the QA representative, participating in the proposed site investigation project . Include titles, responsibilities, and organization affiliation of all project participants. (Fill-in the blanks, if applicable, otherwise insert another project specific chart.)



Note: In lieu of completing an organizational chart, a table specifying the key personnel, their titles, and responsibilities is sufficient to delineate the infrastructure of the proposed Brownfields site investigation project.

B.2 Personnel Information

The environmental professional leading (Task Leader) a proposed site-specific Brownfields investigation is responsible for providing technical direction to their staff concerning project objectives, sampling needs, and schedule. In this capacity, the Task Leader is required to act as the primary point of contact for the municipality with the subject environmental regulatory authorities. Hence, the Task Leader is responsible for the development and completion of the Site-Specific Brownfields SAMP, project team organization, and supervision of all project tasks.

Alternately, the QC Coordinator working independent of the Task Leader on a proposed site-specific Brownfields investigation is likewise responsible for ensuring all field personnel adhere to the SAMP. In this capacity, the QC Coordinator shall likewise oversee and record any necessary deviations from the SAMP that may be required. In addition, the QC Coordinator shall monitor the collection of all in-situ environmental measurement data and also act as the primary contact with the analytical laboratory retained to perform all confirmatory analyses.

To better understand the roles of the key individuals named in the organizational chart, a brief summary explaining each person's responsibility for their given project activity is required in the Site-Specific Brownfields SAMP. In addition, the telephone numbers should also be provided for each of the key individuals listed to facilitate communication.

B.3 Laboratory Information

An essential component of the environmental measurement data collection process is to delineate the analytical laboratory(ies) responsible for performing all confirmatory analyses.

Therefore, develop a table summarizing the laboratory name, location, contact, telephone number, and analyses to be performed in the Site-Specific Brownfields SAMP.

Laboratory Name & Address[1]	Contact & Telephone Number	Sample Analyses

[1] Demonstration of a laboratory's capability, with respect to their ability to analyze selected contaminants, should be ascertained whenever possible. One approach to rendering such a determination is to obtain Performance Evaluation (PE) results for any pertinent analyses from an ongoing state or federal monitoring program. If no applicable PE results are available, method control samples containing the analytes of interest at the concentration levels of concern could be submitted prior to initiating the project for pre-qualification. Alternately, an on-site audit or a quality assurance management plan review may be sufficient mechanisms means to assess a laboratory's ability.

C.0 Site Background

The Site-Specific Brownfields SAMP shall contain Historical Data Review and Site Reconnaissance Reports. The Historical Data Review and Site Reconnaissance Reports are to be generated by undertaking a Phase I Brownfields Site Assessment.

C.1 Historical Data Review Report

To identify potentially contaminated areas of a Brownfields site, it is customary to prepare a Historical Data Review Report to examine previous site operations and disposal practices. This initial "environmental assessment" is commonly referred to as a Phase I Brownfields Site Assessment. Undertaking a Phase I Brownfields Site Assessment is useful in its ability to form the basis of a Historical Data Review Report summary for project planning purposes. Sources of information include federal, state and local officials and files (site inspection reports and legal actions), deed or title records, former facility employees, local residents, and facility records. Historical sampling data should include all available information such as sample locations (on maps when available), matrices, methods of collection and analysis, and relevant contaminant concentrations.

In accordance with the aforementioned requirements, the Site-Specific Brownfields SAMP must provide a summary of the history/background of the particular property under investigation. When available, historical monitoring results from previous investigations may also be relied upon to provide an understanding of the environmental condition of the site. However, it is essential to assess the reliability and usefulness of existing analytical data. Existing analytical data without documentation or QA/QC controls may still be useful, and should be included in the Historical Data Review Report summary. The Historical Data Review Report summary shall describe site-specific chemical processes, raw materials, final products, wastes, and waste storage/disposal practices to the greatest possible extent. In addition, it is customary to include site maps along with facility blueprints and aerial photographs when available in the Historical Data Review Report summary. In conjunction, a local Agricultural Extension Agent should be contacted to provide insights into soil types and drainage patterns. County property and tax records, and United States Geological Survey (USGS) topographic maps are additional sources of site and regional information.

To ensure Phase I Brownfields Site Assessment historical data review reports and supporting topographic information are properly assembled, it is advantageous to follow an accepted guide on conducting a preliminary environmental investigation. Fortunately, there are many guides specific to performing Phase I site assessment activities available (ASTM E 1528 [1], ASTM E 1527 [2], U.S. Postal Service Facilities Environmental Guide [3], N.J.DEP Technical Requirements for Site Remediation [4], etc.). These guidance documents discuss project planning, historical/background review, site reconnaissance, and the evaluation and reporting of collected information. As such, the ***U.S.EPA Guidance for Performing Preliminary Assessments Under CERCLA*** *[5] is the agency's formal site assessment protocol. To facilitate these efforts, the U.S.EPA Preliminary Assessment Guide is included as an appendix to Volume 1 of this guidance. It should be noted that although a variety of accepted protocols exist for conducting a Phase I site assessment, a single guidance should be used exclusively to avoid confusion.*

C.2 Site Reconnaissance Reports

Site Reconnaissance Reports evaluate site conditions to identify potentially contaminated areas and sampling hazards. These surveys are used to prepare correct and cost-effective site-specific project plans. The Site Reconnaissance Report corrects deficiencies in the Historical Review Report by:

- Interviewing local residents and past employees about site-related activities.
- Researching facility files and records (if available).
- Visiting and photographing the Brownfields site.
- Delineating the presence or absence of the following site characteristics: waste disposal areas, lagoons, site wastes, dead animals, dead or stressed vegetation, and visible label information on drums, tanks, and containers.

C.3 Project Definition:

In this section of the Site-Specific Brownfields SAMP, briefly state the problem that the data collection project is designed to solve and/or the decisions to be made (the project objectives). This summary is to include a description of the relevant characteristics of the site, such as site use history, suspected contaminants and their location, range of contaminant concentrations, media that may be affected, and likely migration routes. When applicable, cite previous studies that indicate why the site investigation project is needed.

D.0 Data Use Objectives:

At Brownfields Sites, typical data use objectives are:

- Ascertaining if there is a threat to public health or the environment.
- Locating and identifying potential sources of contamination. Sampling data are used when formulating remediation strategies, and estimating remediation costs.
- Delineating horizontal and vertical contaminant concentrations, identifying clean areas, estimating volume of contaminated soil, and establishing a clearly defined removal design.
- Determining treatment and disposal options. Characterizing soil for on-site or off-site treatment.
- Verifying the attainment of clean-up goals. Ascertaining if additional remediation is required.

D.1 Brownfields Site Investigation Reports

Upon the completion of a Brownfields environmental monitoring project, a Site Investigation Report is to be developed. Brownfields Site Investigation Reports are always to include one or more of the following recommendations to summarize the environmental condition of the property:

- Additional sampling is required.
- Undertake remediation.
- No additional actions are required.

It is important to note that Brownfields Site Investigation Reports should present data to substantiate any of the aforementioned recommendations concerning the environmental condition of the property.

D.2 Quality of Data Needed for Environmental Data Measuring

Brownfields environmental measurement data shall always be of sufficient quality to ensure that sampling results accurately characterize site conditions. Often important and potentially costly decisions concerning the re-development of Brownfields sites will be based on sampling data. To ensure that Brownfields site investigation results provide an accurate characterization of environmental conditions inherent to a property, Site-Specific Brownfields SAMPs shall:

- Logically evaluate available site information.
- Select an appropriate sampling design.
- Select and utilize suitable geophysical, analytical screening, and sampling techniques.
- Employ proper sample collection and preservation techniques.
- Collect and analyze appropriate quality assurance/quality control (QA/QC) samples.
- Logically present and interpret analytical and geophysical data.
- Define data usability criteria.

In most instances, Brownfields site investigation data will typically consist of in-situ field analytical screening and fixed laboratory results. In-situ field analytical screening techniques such as Photo Ionization Detectors (PIDs), portable X-Ray Fluorescence (XRF) units, and hazard categorization kits can provide real-time or direct reading capabilities. These screening methods are recognized to be cost-effective tools for identifying potential contaminants of concern. However, it is essential that all screening results be corroborated with a subset of duplicate samples designated for fixed laboratory confirmatory analysis to document method performance. This is done to minimize the occurrence of false negative screening data (inadvertently not detecting contamination) by requiring at least 20% of these samples be sent to a fixed laboratory for confirmation.

It is important to note that Brownfields sampling budgets can be used more effectively by incorporating in-situ field analytical techniques into the overall data collection process. In-situ field analytical screening and geophysical measurements are cost-effective strategies for selecting sampling locations and characterizing Brownfields sites. This involves specifying an appropriate blend of field screening techniques with confirmatory fixed laboratory analyses. In doing so, this will limit the need for submitting each and every sample to an off-site laboratory for analysis. Therefore, to determine an appropriate analytical scheme, it is prudent to consult a scientist well-versed in the use of field screening technologies and sampling network design.

In-situ field analytical screening methods with minimum detection limits above U.S.EPA Contract Laboratory Program (CLP) quantitation levels may be useful for some sampling events to identify grossly contaminated areas. These same techniques can also prove useful in identifying clean areas and/or background samples. Likewise, approximately 50% of all background samples or "presumed clean" reference samples should always undergo confirmatory fixed laboratory analysis to limit false negative and sampling errors. This is due to the fact that the sensitivity of most field screening instruments (or assay techniques) may not be adequate to assess federal and/or state Applicable or Relevant and Appropriate Requirements (ARARs) and/or To Be Considereds (TBCs). In instances where suitable field analytical methods are not available, laboratory determinations with limited deliverables should be prescribed.

For some site investigation efforts there may be instances when the ARARs and/or TBCs applicable to a given project may fall well below specified U.S.EPA CLP quantitation levels. Situations such as these need to be dealt with on case-by-case basis with the appropriate subject environmental regulatory agency(ies). In conjunction, certain states have promulgated guidance delineating the collection and use of field analytical screening data. For instance, some states may require up to 50% of all samples be sent to a fixed laboratory for confirmatory analysis. Therefore, it is prudent to consult your subject state or commonwealth environmental regulatory agency Remedial Project Manager (RPM) before initiating the use of an in-situ field analytical technique.

Geophysical techniques are another known group of in-situ field screening technologies which can prove useful when conducting remedial investigation projects such as removal actions to identify buried drums, tanks and waste. Geophysical techniques include ground penetrating radar (GPR), magnetometry, electromagnetic conductivity (EM) and resistivity surveys. These techniques can be most useful when

undertaking a Brownfields site investigation project because they can provide a means for locating sub-surface anomalies. Hence, these technologies should always be considered when developing a Site-Specific Brownfields SAMP to facilitate sampling network design efforts.

D.3 Project Description:

In this section of the Site-Specific Brownfields SAMP, provide a detailed description of the work to be performed. This description shall identify the media to be sampled, whether field or fixed laboratories will be used, if in-situ field analytical screening methods will be used, likely action levels, anticipated work schedules, required reports, etc.

D.4 Project Time Line:

The progress of any project should be tracked from its inception, through implementation, to ensure all sampling and analytical activities are performed in a correct and cost effective manner. As a result, it is often beneficial to plot each phase of the site investigation effort as noted in the project schedule, from the initial request to the final project report. Each step in this process should be scheduled in an objective and realistic time frame to assure that adequate attention is devoted to every pertinent task. In doing so, each task can be planned in a manner to minimize effort and maximize the acquisition of information.

In this section of the Site-Specific Brownfields SAMP, create an overall project timetable that outlines beginning and ending dates for the entire project, as well as, specific activities and products within the project as follows:

Activities *(Includes Products and/or Services)*	Dates *(MM/DD/YY)*	
	Activity Start Date	Activity End Date

E.0 Sampling and Analysis

The purpose of performing a Brownfields site investigation is to determine the presence and identity of contaminants, as well as, the extent to which they have become integrated into the surrounding environment. The objective of this effort will be to collect and analyze environmental samples which are representative of the media under investigation. The methods and equipment used for collecting environmental matrices of concern will vary with the associated physical and chemical properties of each media designated for sampling.

To ensure sampling and analytical protocols are appropriate, it is necessary to describe the objectives and details comprising these activities. As a result, the design of a proper sampling scheme, including protocols for collecting rinse blanks, trip blanks, duplicates, and background samples should be derived from an accepted guidance. As such, the ***U.S.EPA Superfund Program Representative Sampling Guidances, Volume 1: Soil*** [6]***; Volume 5: Water and Sediment, Part 1 - Surface Water and Sediment*** [7]**;** ***Volume 5: Water and Sediment, Part II - Ground Water*** [8] are included as attachments to this generic QAPP boilerplate. These media specific guides are the U.S.EPA's formal sampling Guidances which outline protocols for the collection of representative samples to ensure the accurate characterization of site conditions. Therefore, following these guides will assist in the design of a fitting sampling network which is thoroughly justified and documented in the corresponding Site-Specific Brownfields SAMP.

E.1 Sampling Design

The intent of this section is to describe the overall monitoring system by providing a justification for the design of a proposed sampling network and the identification of specific sample locations. To design a suitable monitoring network, it is important to consider sample representativeness, comparability, and completeness. In addition, any other relevant factors influencing the design of a proposed sampling network must be discussed in the Site-Specific Brownfields SAMP (homogeneity of the system under investigation, accessability of the sampling area, stream flow conditions, tidal fluctuation, weather conditions, etc.).

To design an appropriate sampling network, utilize the attached ***Superfund Program Representative Sampling Guidances*** in conjunction with the Site-Specific Brownfields SAMP template to outline sampling and analysis criteria for a given site investigation. It is important to note that at least 20% of all pertinent field screening data must be confirmed by analyzing a duplicate subset of samples with CLP protocols at a fixed off-site laboratory. In conjunction, it is essential that approximately 50% of all background samples or "presumed clean" reference samples undergo fixed lab CLP confirmatory analysis as well to limit false negative and sampling errors.

Therefore, in this section of the Site-Specific Brownfields SAMP, summarize the proposed sampling network design for the investigation of a particular property. This summary must provide a rationale for the selection of sampling locations for each parameter/matrix to be sampled during the project. For instance, a judgmental sampling strategy with broad spectrum analysis using the ***Superfund Program Representative Sampling Guidances*** *may be designated. In addition, identify all action levels pertinent to*

the site investigation project. A detailed site map with anticipated sampling locations should be included. When applicable, describe all in-situ field analytical screening techniques that will be utilized and identify the number of samples which will be sent for confirmatory U.S.EPA CLP analyses.

F-1.0 Standard Operating Procedures

Often many routine laboratory and field operations are cataloged to form Standard Operating Procedures (SOPs). Whenever SOPs are applicable and available, they should always be incorporated into the overall data collection activities inherent to performing a Brownfields site investigation. Site-Specific Brownfields SAMPs should delineate all activities which could directly or indirectly influence data quality. This should include a determination of all operations which can be covered by SOPs. Therefore, all Site-Specific Brownfields SAMPs should contain, at a minimum, SOPs for the following operations:

- Sampling and analytical methodologies.
- Field equipment selection and use.
- Field equipment calibration and standardization.
- Field equipment preventive maintenance.
- QC procedures for intra-laboratory and intra-field activities.
- Data validation.
- Document control procedures.

F-1.1 Sampling SOPs

To ensure environmental sample collection efforts are representative of site conditions, it is customary to utilize accepted SOPs to optimize sampling activities. Sampling SOPs are typically proven protocols which may be varied or changed, as required, depending upon site conditions and/or equipment limitations imposed by the procedure. In all instances, those sampling procedures which will be employed to collect environmental samples for a given site investigation must be documented in the Site-Specific Brownfields SAMP.

To facilitate the selection of appropriate sample collection techniques, it is advantageous that the sampling SOPs employed for a site-specific Brownfields investigation be derived from an accepted guide. As such, the ***U.S.EPA Compendia of Emergency Response Team (ERT) Sampling Procedures*** including ***Soil Sampling and Surface Geophysics Procedures*** [9], ***Surface Water and Sediment Sampling Procedures*** [10], and ***Groundwater Sampling Procedures*** [11] are included as attachments to this generic QAPP boilerplate. These media specific sampling protocols are the U.S.EPA's accepted SOPs for collecting potentially contaminated environmental matrices of concern such as soil and water. Therefore, to optimize sample collection efforts, these protocols are to be used in conjunction with the ***Superfund Program Representative Sampling Guidances***.

F-1.2 SOP Reference Table

In this section of the Site-Specific Brownfields SAMP, utilize the following form to create an SOP Reference Table. Subsequently, the appropriate number/letter reference from this table will be used to complete Forms F-2 through J, and Form L. In addition, it is essential to attach all referenced Project Analytical and Sampling SOPs to the Site-Specific Brownfields SAMP.

ANALYTICAL METHOD REFERENCE (*Include document title, method name/number, revision number, date)*
1a.
2a.
3a.
4a.
PROJECT ANALYTICAL SOPs (*Include document title, date, revision number, and originator's name)*
1b.
2b.
3b.
4b.
PROJECT SAMPLING SOPs [1] (*Include document title, date, revision number, and originator's name)*
1c.
2c.
3c.
4c.
[1] Project Sampling SOPs include sample collection, sample preservation, equipment decontamination, preventive maintenance, etc...

F-2.0 Sampling and Analytical Parameters

The intent of this section is to discuss the types of parameters to be collected at the designated sampling locations comprising a Brownfields site investigation. This is done in tabular format which is provided in this project plan. The analytical method reference table is provided below to delineate the sample type corresponding to a given analytical parameter. *Therefore, in this section of the Site-Specific Brownfields SAMP, detail the data collection and analysis design for the project. Tabulate by matrix/parameter(s) the analytical method(s) for analyzing each matrix of concern, and the anticipated detection limit(s) of the selected laboratory protocols. Insert the appropriate SOP number/letter reference in the table. Form F-1 contains the Method and SOP Reference Table. Attach analytical SOPs for sample collection and analysis for each parameter/matrix.*

Matrix (Sample Type)[1]	Number of Samples[2]	Sampling SOP[3]	Parameter/Fraction	Minimum Sample Volume[4]	Sample Container[5]	Sample Preservation	Analytical Method[6]	CLP Contractual Reporting Limit	Technical Holding Time
Soil (_____)			Target Compound List (TCL):						
			Volatile Organics (VOCs)	4 oz.	2 oz. clear wide-mouth glass with Teflon lined septum.	Cool to 4EC	OLM0 4.2	10 Fg/kg	14 days
			Acid Extractable Organics Base & Neutral Organics (BNAs)	4 oz.	4 oz. amber wide-mouth glass with Teflon lined cap.	Cool to 4EC	OLM0 4.2	Compound Specific (330-830 Fg/kg)	7 days extract; 40 days analyze
			Pesticides/Aroclors (PCBs)	4 oz.	4 oz. amber wide-mouth glass with Teflon lined cap.	Cool to 4EC	OLM0 4.2	Compound Specific (1.7-170 Fg/kg)	7 days extract; 40 days analyze
			Target Analyte List (TAL):						
			Total Metals	6 oz.	8 oz. clear wide-mouth glass with Teflon lined cap.	Cool to 4EC	ILM0 4.0	Analyte Specific (0.2-5000 Fg/L)	180 days; (28 days Hg)
			Cyanide	6 oz.	8 oz. clear wide-mouth glass with Teflon lined cap.	Cool to 4EC	ILM0 4.0	10 Fg/L	14 days

Legend:

[1] Sample Type: insert sample location, identification number, and sample depth when necessary.

[2] The number of samples includes one field duplicate sample.

[3] The reference number corresponds to the Project Sampling SOP delineated in Form F-1.

[4] Triple volume is required for matrix spike/matrix spike duplicate analysis.

[5] All sample bottles must comply with the *U.S.EPA Specifications and Guidance for Contaminant-Free Sample Containers*, OSWER Directive #9240.0-05A, EPA 540/R-93/051.

[6] The complete analytical method citation is delineated in Form F-1.

Matrix (Sample Type)[1]	Number of Samples[2]	Sampling SOP[3]	Parameter/Fraction	Minimum Sample Volume[4]	Sample Container[5]	Sample Preservation	Analytical Method[6]	CLP Contractual Reporting Limit	Technical Holding Time
Aqueous (_____)		_____	Target Compound List (TCL):						
			Volatile Organics (VOCs)	80 ml	40 ml VOC vial with Teflon lined septum.	1:1 HCl to pH<2; Cool to 4EC; 25 mg Ascorbic Acid[7]	OLM0 4.2	10 Fg/L	14 days
			Acid Extractable Organics Base & Neutral Organics (BNAs)	2 Liters	1 Liter amber glass with Teflon lined cap.	Cool to 4EC; 80 mg $Na_2S_2O_3$ (sodium thiosulfate)[8]	OLM0 4.2	Compound Specific (10 - 25 Fg/L)	7 days extract; 40 days analyze
			Pesticides/Aroclors (PCBs)	2 Liters	1 Liter amber glass with Teflon lined cap.	Cool to 4EC	OLM0 4.2	Compound Specific (0.05-5.0 Fg/L)	7 days extract; 40 days analyze
			Target Analyte List (TAL):						
			Total Metals	1 Liters	1 Liter HDPE bottle with Teflon lined cap.	1N HNO_3 to pH<2; Cool to 4EC	ILM0 4.0	Analyte Specific (0.2-5000 Fg/L)	180 days (28 days Hg)
			Cyanide	1 Liters	1 Liter HDPE bottle with Teflon lined cap.	NaOH to pH>12; Cool to 4EC; 25 mg Ascorbic Acid[8]	ILM0 4.0	10 Fg/L	14 days[9]

Legend:
1 Sample Type: insert sample location, identification number, and sample depth when necessary.
2 The number of samples includes one field duplicate sample.
3 The reference number corresponds to the Project Sampling SOP delineated in Form F-1.
4 Triple volume is required for matrix spike/matrix spike duplicate (MS/MSD) analysis.
5 All sample bottles must comply with *U.S.EPA Specifications and Guidance for Contaminant-Free Sample Containers*, OSWER Directive #9240.0-05A, EPA 540/R-93/051.
6 The complete analytical method citation is delineated in Form F-1.
7 Ascorbic Acid should only be used in the presence of residual Chlorine.
8 Sodium thiosulfate ($Na_2S_2O_3$) should only be used in the presence of residual Chlorine.
9 Maximum holding time is 24 hours when sulfide is present.

G.0 Preventative Maintenance - Field Equipment

The purpose of this section is to delineate the SOPs/methods which will be utilized to ensure that all field equipment will function in an optimum manner. This summary should reference all pertinent SOPs/methods for performing these activities. It should also include a brief description of each specified procedure along with the frequency of application for employing these methods.

It is important to note that all field equipment should be maintained in accordance with each respective instrument manufacturer's operating instructions with all maintenance activities recorded in a log book. Each equipment log book should remain with instrument except when it is sent out for repairs. This equipment log book is useful in tracking records of usage, maintenance, and repairs.

Therefore, in this section of the Site-Specific Brownfields SAMP, identify the field equipment and/or systems requiring periodic preventive maintenance. Cite all references on how periodic preventive and corrective maintenance of field measurement or test equipment shall be performed to ensure availability and satisfactory performance. Include descriptions of how to resolve field instrument deficiencies and when re-inspections will be performed. In addition, describe the availability of spare parts identified in the manufacturer's operating instructions and how SOPs will be maintained.

Instrument	Activity	Frequency	SOP Reference[1]

[1] **Insert the appropriate reference number/letter from Form F-1, Method and SOP Reference Table.**

H.0 Calibration and Corrective Action - Field Equipment

The purpose of this section is to delineate the SOPs/methods which will be used to ensure that all field equipment calibration and corrective actions will be performed in a proper manner. This summary should reference all pertinent SOPs/methods for performing these activities. It should also include a brief description of each specified procedure along with the frequency of application for employing these methods. In conjunction, it is essential that these activities should always be recorded in a log book.

Performing instrument calibration is a necessary function which ensures the accuracy and precision of field testing equipment. Subsequently, the following procedures should always be implemented when calibrating field instrumentation:

- Reference the applicable SOP or provide a written description of the calibration procedure(s) used for each field measurement system.
- List the frequency planned for re-calibration and/or the criteria, including acceptance limits, utilized to dictate the frequency of re-calibration.
- List the calibration standards to be used and their source(s), including traceability procedures.

Corrective actions are the processes for rectifying a field measurement system which is not operating within specified control limits. These techniques which facilitate the collection of representative field measurement data should always include the following information:

- The pre-determined limits for data acceptability beyond which corrective action is required.
- Procedures for corrective actions.
- Identity the individuals responsible for initiating and approving the implementation of corrective actions for each measurement system.

Therefore, in this section of the Site-Specific Brownfields SAMP, identify all tools, gauges, and equipment for field screening data collection efforts which require calibration to operate within specified limits. Reference all calibration procedures using certified equipment and standards with recognized performance criteria. In addition, specify the procedures for maintaining calibration and corrective action records.

Instrument	Activity	Frequency	Acceptance Criteria	Corrective Action	SOP Reference1

[1] Insert the appropriate reference number/letter from Form F-1, Method and SOP Reference Table.

I.0 Preventive Maintenance - Laboratory Equipment

The purpose of this section is to delineate the SOPs/methods used to ensure the optimum performance of laboratory equipment. It is essential that the frequency and application of these methods be appropriately recorded in a log book. In conjunction, it is advantageous to provide a schedule of all the routine preventive maintenance tasks which will be performed to minimize laboratory instrument downtime. It is customary that these SOPs/methods note and address all critical spare parts that should be on hand to minimize instrument downtime.

All laboratory equipment should be maintained in accordance with each respective instrument manufacturer's operating instructions with all maintenance activities recorded in a log book. Each equipment log book should remain with instrument except when it is sent out for repairs. This equipment log book is useful in tracking records of usage, maintenance, and repairs.

Therefore, in this section of the Site-Specific Brownfields SAMP (when applicable), identify the laboratory equipment and/or systems requiring periodic preventive maintenance. Cite references on how periodic preventive and corrective maintenance of equipment shall be performed to ensure availability and satisfactory performance. Likewise, specify how the availability of critical spare parts which are identified in the instrument manufacturer's operating instructions and/or SOPs will be assured and maintained.

Instrument	Activity	Frequency	SOP Reference1

[1] Insert the appropriate reference number/letter from Form F-1, Method and SOP Reference Table.

J.0 Calibration and Corrective Action - Laboratory Equipment

An integral element of a Brownfields site investigation is to ensure that all of the designated laboratory instrumentation are capable of meeting the project requirements for selective, sensitive, accurate and precise quantitation of environmental contaminants. As a result, it is necessary to specify the calibration procedures and corrective actions pertinent to operating all specified laboratory instrumentation. This involves describing the corrective actions for resolving calibration check samples which exceed specified control limits, calibration curve drift, reagent blank contamination, etc. To facilitate these efforts, it is important to record the frequency of calibration and any necessary corrective actions in a log book.

The purpose of this section is to delineate the analytical techniques which will assure the laboratory instrumentation employed will accurately and precisely quantitate the target analytes of concern. Hence, it is essential to identify all the tools, gauges, and instruments which must be calibrated to affirm data measurement activities are within known limits. To facilitate these efforts, it is important to specify all instrument calibration procedures using certified equipment and standards with recognized acceptance/performance criteria. In conjunction, it is essential to specify the procedures for maintaining all pertinent calibration and corrective action records.

Therefore, in this section of the Site-Specific Brownfields SAMP (when applicable), specify the calibration and corrective action criteria for operating all pertinent laboratory instrumentation. However, the project objectives and acceptance/performance criteria put forward in this generic QAPP boilerplate specify the use of our U.S.EPA CLP analytical Statements of Work (SOWs) for acquiring all confirmatory data. The U.S.EPA CLP SOWs delineate all of the pertinent calibration procedures and corrective actions required to perform these analyses. As a result, cite that the calibration procedures and corrective actions which will be employed for each respective Brownfields site investigation are to performed in accordance with the appropriate U.S.EPA CLP SOW. For Target Contaminant List (TCL) determinations, specify the use of U.S.EPA Contract Laboratory Program Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration OLM0 4.2 12 or latest revision. For Target Analyte List (TAL) determinations, specify the use of U.S.EPA Contract Laboratory Program Statement of Work for Inorganics Analysis, Multi-Media, Multi-Concentration ILM0 4.0 13 or latest revision.

K.0 Sample Documentation and Handling

An essential element of any Brownfields sampling/analytical scheme is to maintain sample integrity from collection to data reporting. This involves tracing the possession and handling of samples from the time of collection through analysis and final disposition. The documentation used to track a sample's history is referred to as the "chain-of-custody." To facilitate sample chain-of-custody efforts, it is essential to record all inspections, investigations, and photographs which are taken, as well as, perform a thorough review of all notes before leaving the site.

To promote the management of sample integrity, it is important that all parties involved understand that a sample is considered to be under a person's custody if; (a) it is in a person's physical possession, (b) in view of that person after he/she has taken possession, (c) secured by that person so that no one can tamper with the sample, or (d) secured by that person in an area which is restricted to authorized personnel. A person who has samples under their custody must always comply with these procedures in order to assure sample integrity.

K.1 Sample Documentation

All sample documents should always be legibly written in ink. Any corrections or revisions to sample documentation shall be made by lining through the original entry and initialing any changes. To elaborate on these requirements, the following sub-sections are provided to outline sample documentation procedures which should be employed when conducting a Brownfields investigation.

K.1.1 Field Logbook

The field logbook is a descriptive notebook detailing site activities and observations so that an accurate and factual account of field procedures may be reconstructed. All entries should be signed by the individuals who are making them. Nonetheless, all field logbook entries should always document the following specific information:

- Site name and project number.
- Contractor name and address.
- Names of personnel on site.
- Dates and times of all entries.
- Descriptions of all site activities, including site entry and exit times.
- Noteworthy events and discussions.
- Weather conditions.
- Site observations.
- Identification and description of samples and locations.
- Subcontractor information and names of on-site personnel.
- Dates and times of sample collections and chain of custody information.
- Records of photographs.
- Site sketches.

- All relevant and appropriate information delineated in field data sheets and sample labels.

K.1.2 Field Data Sheets and Sample Labels

Field data sheets, along with corresponding sample labels, are routinely used to identify samples and document field sampling conditions and activities. Field data sheets should be completed at the time of sample collection and should always include the following information:

- Site name.
- Contractor name and address.
- Samplers name.
- Sample location and sample identification number.
- Date and time the sample was collected.
- Type of sample collected.
- Brief description of the site.
- Weather conditions.
- Analyses to be performed.
- Sample container, preservation, and storage information.

Sample labels are always to be securely affixed to the sample container. They must always clearly identify the particular sample, and delineate the following information:

- Site name and designated project number.
- Sample identification number.
- Date and time the sample was collected.
- Sample preservation method.
- Sample pH.
- Analysis requested.
- Sampling location.

K.1.3 Chain of Custody Record

A chain-of-custody record must always be maintained from the time of sample collection until final deposition. Every transfer of custody will be noted and signed for with a copy of the record being kept for each individual which endorsed it. It is integral that the chain-of-custody record should always include the following information:

- Contractor name and address.
- Sample identification number.
- Sample location.
- Sample collection date and time.
- Sample information (matrix type, number of bottles collected, container type, etc).
- Names and signatures of samplers.
- Signatures of all individuals who have had custody of the samples.

K.1.4 Custody Seals

Custody seals are used to demonstrate that a sample container has not been opened or tampered with. The individual who has sample custody shall always sign, date, and affix the custody seal to the sample container in such a manner that it cannot be opened unless it is broken. When samples are not under direct control of the individual currently responsible for them, they will be stored in a locked container which is also to be affixed with a custody seal.

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K.2 Sample Handling and Shipment

It is customary for field sampling personnel to always transport environmental samples directly to the laboratory within 24 hours of sample collection. To assist in these efforts, field sampling personnel should consider utilizing an overnight delivery service within 24 hours of sample collection.

When preparing sample containers for shipment they should always be securely closed with a custody seal affixed to each cap. All sample containers will be labeled as described above. Subsequently, they are to be placed in an appropriate transport container and packed with an absorbent material such as vermiculite. All sample containers will be packed with ice to maintain a temperature of 4°C. All sample documentation will then be affixed to the underside of each transport container lid. The transport container lid will then be closed and affixed with a custody seal accordingly.

Regulations for packaging, marking/labeling, and shipping hazardous materials and wastes are issued by the U.S. Department of Transportation (U.S. DOT). Air carriers which transport hazardous materials, such as Federal Express, may also require compliance with the current edition of the International Air Transport Association (IATA) Dangerous Goods Regulations. The IATA protocol details the procedures for the shipment and transportation of hazardous materials by a common air carrier. It is important to note that following all current IATA regulations will ensure compliance with U.S. DOT protocol.

K.3 Sample Handling and Chain of Custody Requirements

Therefore, in the Site-Specific Brownfields SAMP, specify the processes which will be followed for maintaining environmental sample integrity. This involves describing the sample handling and chain-of-custody procedures which will be followed. This description should also indicate the sample containers, sample numbering system, sample shipment mechanisms, chain-of-custody forms, sample tags, and custody seals the field sampling personnel will utilize. It is important to note that all of the applicable SOPs for collecting, transferring, storing, analyzing, and the disposing of samples should be delineated on Form F-1 accordingly.

To facilitate these efforts, the ***U.S.EPA Sampler's Guide to the Contract Laboratory Program*** [14] is included as an attachment to this QAPP boilerplate. The U.S.EPA Sampler's Guide is designed to assist field sampling personnel in clarifying the procedures necessary to submit environmental samples for CLP analyses. It is intended to only serve as a guide for planning Brownfields sample handling and chain-of custody procedures. As a result, please do not contact any of the representatives listed in the U.S.EPA

Sampler's Guide or forward any of the required paper-work to the agency unless utilizing our CLP resources.

FORM L: ANALYTICAL PRECISION AND ACCURACY

L.0 Analytical Data Quality Requirements and Assessments

An important aspect in the Brownfields project planning process is to define what levels of data are required. These data quality requirements are to be based on a common understanding of its intended use, the complexity of the measurement process, and the availability of resources. Once data quality requirements are clearly determined, QC protocols are to be defined for measuring whether these environmental monitoring acceptance/performance criteria are being met.

L.1 Data Acceptance/Performance Criteria

When conducting a Brownfields site investigation, it is essential to collect data which are of sufficient quantity and quality to support accurate decision making. The most effective way to accomplish these objectives is to determine the type, quantity, and quality of environmental measurement data which are necessary to achieve monitoring goals prior to the commencement of sampling. To assure the level of detail is commensurate with the objectives of a Brownfields site investigation, a common sense "systematic planning" approach should be followed. This process is useful in promoting the development of "acceptance and/or performance criteria" for gauging the collection, evaluation, and use of environmental measurement data.

Data "acceptance and/or performance criteria" are prerequisites established to specify the quality of Brownfields site investigation environmental monitoring results required to support decisions. Data acceptance/performance criteria are predicated in accordance with the anticipated end uses of the information which are to be collected. The establishment of data acceptance/performance criteria are applicable to all phases and aspects of the remediation process including site investigation, design, construction, and clean up operations. It is important to note that the level of detail and quality needed will often vary with the intended use of the data. Consequently, in most instances QA/QC activities involving precision and accuracy determinations are relied upon to assess acceptance/performance criteria.

L.2 Analytical Precision

Analytical precision measurements are typically determined when performing instrumental analyses to assess the errors associated with analyte interferences, sample heterogeneity, and poor laboratory practices. They are commonly undertaken by incorporating matrix spike, matrix spike duplicate, and/or matrix duplicate quality control sample analyses into the analytical scheme. Precision measures are often best expressed by calculating the Relative Percent Difference (RPD) between a sample and its duplicate determination. The Relative Percent Difference (RPD) between the two results will be calculated as follows and used as an indication of the precision of the analyses performed:

$$RPD = \frac{|S - D|}{(S+D)/2} \times 100$$

S = Sample
D = Duplicate
| | = Indicates absolute value of the difference to express RPD as a positive value.

FORM L: ANALYTICAL PRECISION AND ACCURACY

L.3 Analytical Accuracy

Analytical accuracy determinations are typically undertaken when performing instrumental analyses to assess the proficiency of the measurement process. They are commonly undertaken by incorporating calibration verification, method blank, calibration blank, method control, surrogate spike, and/or matrix spike quality control sample analyses into the analytical scheme. Accuracy measures are often best expressed by calculating the Percent Recovery (%R) between true and found values as follows:

$$\% R = A/B \times 100$$

A = The found analyte concentration determined experimentally.

B = The true analyte concentration.

L.4 Analytical Precision and Accuracy Requirements

When performing environmental monitoring analyses in support of a Brownfields site investigation project, it is essential that the laboratory provide an accurate and precise quantitation of each target analyte of concern. Therefore, in this section of the Site-Specific Brownfields SAMP, delineate the analytical techniques for assuring the laboratory instrumentation employed is utilized properly. This will involve identifying the analytical methods and equipment required, including sub-sampling or extraction methods, laboratory decontamination procedures and materials, waste disposal requirements (if any), and specific performance requirements (quantitation levels, precision limits, accuracy limits, etc.) for each method. These requirements are to be summarized in the following sub-sections for all fixed laboratory confirmatory and in-situ field screening analyses which will undertaken when conducting a site-specific Brownfields investigation.

L.4.1 Fixed Laboratory Precision and Accuracy Requirements

The project objectives and acceptance/performance criteria outlined in this generic QAPP boilerplate rely on the use of our U.S.EPA CLP SOWs for acquiring all fixed laboratory confirmatory data. As a result, the U.S.EPA CLP SOWs delineate all of the pertinent analytical precision and accuracy protocols for performing these analyses. They describe in detail all of the necessary calibration procedures, quality control sample determinations, acceptance criteria, and corrective actions required to render an accurate and precise quantitation of all the target analytes of concern. Therefore, cite that the analytical precision and accuracy protocols for conducting a site-specific Brownfields investigation are to performed in accordance with the appropriate U.S.EPA CLP SOW. For TCL determinations, specify the use of ***U.S.EPA Contract Laboratory Program Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration OLM0 4.2*** *or latest revision. For TAL determinations, specify the use of* ***U.S.EPA Contract Laboratory Program Statement of Work for Inorganics Analysis, Multi-Media, Multi-Concentration ILM0 4.0*** *or latest revision.*

L.4.2 In-situ Field Analytical Precision and Accuracy Requirements

Many in-situ field analytical screening techniques (immunoassay, XRF, etc.) are often classified as quantitative determinations, although only minimal Quality Assurance/Quality Control (QA/QC) procedures and data deliverable requirements are specified. Unless duplicate samples are analyzed in a fixed laboratory for confirmation, the uncertainty of in-situ field analytical screening data cannot be evaluated. As such, to generate quantitative in-situ field analytical screening data, traditional QA/QC procedures must be employed to identify site-specific false negative and false positive results.

To ensure in-situ field analytical screening data are of an appropriate quality, QA/QC protocols for ascertaining precision and accuracy must be utilized when performing such analyses. Optional QA/QC protocols to consider when performing these analyses include:

- *Sample documentation (recording sample collection location, time & date, and associated field measurements, etc.).*
- *Field analytical screening documentation (providing raw data, calculations, and final results for the field analysis screening of all environmental and accompanying QC samples).*
- *Method calibration (requiring the initial and continuing calibration of all field analytical instrumentation according to the instrument manufacturer's operating instructions).*
- *Method blank analysis (requiring that a volume of deionized, distilled laboratory water be carried through the entire analytical sequence with every sample delivery group to check on the occurrence of contamination resulting from sample preparation and measurement activities).*
- *Duplicate sample analysis (requiring the analysis of a duplicate environmental sample with every sample delivery group to document method reproducibility).*
- *Fixed laboratory confirmation analysis (requiring that a portion of all environmental samples analyzed with a field analytical screening technique undergo fixed laboratory quantitation to document method performance).*
- *Method control sample analysis (requiring the analysis of a pre-prepared sample spiked at the action level with every sample delivery group to document method performance).*
- *Matrix spike analysis (requiring the analysis of an environmental sample spiked with the target analyte(s) of concern with every sample delivery group to assess matrix effects).*
- *Continuing calibration verification analysis (requiring the analysis of a known standard every 10 samples to check the accuracy of a measurement process).*

Therefore, in this section of the Site-Specific Brownfields SAMP, describe the QA/QC protocols which will be employed when using in-situ field analytical screening determinations. In conjunction, specify the frequency and acceptance/performance criteria for implementing each prescribed QA/QC procedure. These protocols are essential because they enable Brownfields stakeholders to gauge any uncertainty evident in the data, and logically utilize that data to formulate sensible environmental decisions. Consequently, the utilization of proper QA/QC protocols will enable field measurement data to be quantitative, scientifically valid, and legally defensible.

FORM M: FIELD QUALITY CONTROL REQUIREMENTS

M.0 Data Measurement Quality Objectives

When conducting a Brownfields site investigation, all measurements should be made so that results are reflective of the environmental media and conditions being measured. To assess if environmental monitoring measurements are of an appropriate quality, "acceptance and/or performance criteria" are typically established. Acceptance/performance criteria are commonly assessed by evaluating the Precision, Accuracy, Representativeness, Completeness, and Comparability (PARCC) of pertinent QA/QC options specified for sampling and analytical activities.

- Precision; a measure of the reproducibility of analyses under a given set or conditions.
- Accuracy; a measure of the bias that exists in a measurement system.
- Representativeness; the degree sampling data accurately and precisely depict selected characteristics.
- Completeness; the measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under "normal" conditions.
- Comparability; the degree of confidence with which one data set can be compared to another.

M.1 Sample Collection Precision

Sample collection precision is customarily assessed by collecting field duplicate samples. Field duplicate samples are used to evaluate errors associated with sample heterogeneity, sampling methodology and analytical procedures. The analytical results from these samples are important because they provide data to evaluate overall measurement precision.

M.2 Sample Collection Accuracy

To assess sample accuracy, field QC samples such as rinsate, trip, and/or field blanks, are typically incorporated into the sampling scheme. The data acquired from the analysis of blanks are useful in their ability to evaluate errors which can arise from cross-contamination. The occurrence of cross-contamination can result from the improper handling of samples by field and/or lab personnel, improper decontamination procedures, improper shipment and storage, and on-site atmospheric contaminants. Therefore, to facilitate sample collection accuracy, it is essential to maintain the frequent and thorough review of field procedures so that deficiencies can be quickly documented and corrected.

M.3 Sample Collection Representativeness

Representativeness is an expression of the degree to which a sample accurately and precisely represents a characteristic of a population, parameter variations at a sampling point or an environmental condition. Representativeness is a qualitative parameter which relies upon the proper design of a fitting sampling program and proper laboratory protocol. This criterion is best satisfied by making certain that sampling locations are selected properly and a sufficient number of samples are collected. Therefore, sample representativeness will be assessed by collecting field duplicates. Traditionally, field duplicates are by definition, equally representative of a given point in space and time.

M.4 Sample Collection Comparability

Comparability is defined as an expression of the confidence with which one data set can be compared to another. In most instances, the proficiency of field sampling efforts will be the determining factor which affects the overall comparability of environmental measurement data. To optimize the comparability of environmental measurement data, sample collection activities should always be performed using standardized procedures whenever possible. When performing a Brownfields site investigation, these efforts will be facilitated by adhering to the quality control criteria and technical guidelines put forth in this QAPP boilerplate.

M.5 Sample Collection Completeness

Completeness is defined as the measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct normal conditions. Data completeness is often expressed as the percentage of valid data obtained from a given measurement system. To consider data valid, it is customary to assess if a set of data satisfies all of the specified acceptance/performance criteria (accuracy measures, precision measures, etc.) to render a determination. This necessitates that the data acquired for all confirmatory analyses critical to a Brownfields site investigation sampling program be validated (100%). Therefore, by performing a full data validation effort to ensure completeness, the rationale for considering data points non-critical will not be not required.

M.6 Sampling Quality Control Requirements

Quality control procedures (checks and audit samples) with specified acceptance/performance limits are always to be used when conducting a Brownfields site investigation to monitor sampling operations. These procedures are typically defined in the terms of the objectives to be achieved by an inclusive sampling program. Examples of the pertinent QC checks to be considered for monitoring a sampling effort include the utilization of collocated samples, split samples, field blanks, equipment rinsate blanks, and/or trip blanks.

Therefore, in this section of the Site-Specific Brownfields SAMP, summarize all of the respective sampling quality control activities which will be employed when conducting the investigation of a particular property. To assist in the design of an appropriate quality control program to monitor Brownfields site investigation sampling activities, it is advantageous to follow an accepted guide. As such, the ***U.S.EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations*** [15] *outlines the agency's accepted procedures and prerequisites for planning environmental data operations.*

FORM M: FIELD QUALITY CONTROL REQUIREMENTS

To facilitate the documentation of a program to monitor sample collection operations, the pertinent field sampling QC procedures are to be delineated in the following table:

QC Sample	Frequency	Acceptance Criteria	Corrective Action
Field Quality Control Requirements			
Field Duplicate	5% per parameter per matrix or_____		
Collocated Sample	10% per parameter per matrix [1] or_____		
Split Sample	10% per parameter per matrix [2] or _____		
Equipment Rinsate Blank	5% per parameter per matrix per equipment type per decontamination event or _____		
VOA Trip Blank	1 per cooler or_____		
Other (*Specify*)			

Legend: [1] Applicable to soil/sediment matrices only.
[2] Applicable to groundwater/surface water matrices only.

N.0 Data Reporting

It is essential to the success of any Brownfields site investigation that a data flow or reporting scheme be developed. For any such scheme to be effective, it must address the complete scope of measurement results generated from all facets of an environmental monitoring project including the collection of raw data through the storage of validated results. In addition, it must also completely cover the step-wise procedures for entering data onto various reporting forms, as well as, into computer systems. These procedures should always cover routine data transfer and entry validation checks to ensure these processes are complete. To assist in these efforts, whenever possible pre-printed forms should always be utilized for transcribing data.

N.1 Data Formatting

When conducting a Brownfields site investigation there must always be adequate documentation available to enable the summation of all pertinent measurement data. This is necessary to assist in the interpretation of the data while ensuring that it is both scientifically valid and legally defensible. As a result, it is integral that all records be legible, complete, and properly organized. In some instances, it may be appropriate to utilize a document control system. Therefore, when planning a Brownfields site investigation project, one must consider the type of record to be maintained, and the process for how these records will be stored.

N.2 Field Data Reporting

All real-time measurements and observations must always be recorded in project log books, field data records, or in similar types of record keeping books. Field measurements may include pH, temperature, specific conductance, alkalinity, water flow, soil gas readings, and possibly FID/PID measurements. All measurement data collected by performing in-situ analyses must always be recorded directly and legibly in field logbooks, with all entries being signed and dated. If entries must be changed, it is essential that these changes be made in such a manner that none of the original entries become obscured. Likewise, the reason for making a change should be specified with the correction and explanation being signed and dated at the time the revision was made. Therefore, to ensure the effective management of this information, it is important that field data records be organized into standard formats whenever possible, and retained in permanent files.

N.3 Laboratory Data Reporting

Whenever laboratory data are acquired, an analytical report should always be prepared to summarize the results of each environmental sample analyzed in accordance with this generic QAPP boilerplate. An analytical report should always contain information regarding the analytical methods or procedures employed, sample results, QA/QC results, chain of custody documentation, laboratory correspondence, and all accompanying raw data. It is integral that all data necessary for calculating percent recoveries be presented along with the analytical results.

To facilitate data interpretation efforts, it is advantageous for analytical reports to have all environmental sample data cross-referenced with the appropriate QC audit results (field blank, equipment rinsate blank, field duplicate, matrix spike, and matrix spike duplicate, etc.). Analytical reports should always cross-reference all laboratory data identification numbers with the corresponding field sample codes noted on the chain-of-custody as well. In addition, all pertinent handling/processing dates (time of collection, laboratory receipt, extraction, and analysis) for each sample applicable to the project must be referenced along with the applicable sample holding time.

Another important aspect to consider when formatting requirements for assembling an analytical report are the units for reporting final laboratory results. In most instances, the appropriate units for the reporting of final laboratory results are often dictated by factors such as the environmental sample media, analytical methodology, program/regulatory requirements, project objectives, and performance criteria. Therefore, it is important to specify the appropriate deliverables needed to assemble a complete analytical package for documenting that the pertinent resulting data are of an appropriate quality.

N.4 Data Management and Documentation Requirements

In this section of the Site-Specific Brownfields SAMP, delineate the data management and documentation procedures which will be followed when conducting an investigation of a particular property. This is to include all associated environmental measurement activities pertinent to field sample collection, laboratory analysis, and data storage and use. It is integral that analytical data packages always be assembled to include all of the relevant laboratory documentation needed to interpret the final environmental sample results (case narrative, sample results, QA/QC results, chain of custody documentation, laboratory correspondence, all associated raw data, etc.). Likewise, it is important to describe the envisioned procedures for detecting and correcting errors identified during the data reporting and data entry process. To assist in these efforts, provide examples of any forms or checklists, such as chain-of-custody or field calibration forms, which will be utilized. Traditionally, the type of information/data to request from the participating laboratory(ies) are as follows:

- *Data Results Sheets (include any performance evaluation sample results).*
- *Method Blank Results.*
- *Surrogate Recoveries and Acceptance Limits.*
- *Matrix Spike/Matrix Spike Duplicate Results and Acceptance Limits (organic analyses only).*
- *Spike/Duplicate Results and Acceptance Limits (inorganic analyses only).*
- *Laboratory Control Sample Results and Acceptance Limits.*
- *ICP Serial Dilution Results.*
    - *ICP Interference Check Sample Results.*
- *Project Narrative which contains all observations and deviations.*

N.4.1 Fixed Laboratory Data Deliverable Requirements

The project and data quality objectives put forward in this generic Brownfields QAPP boilerplate specify the use of U.S.EPA CLP SOWs for acquiring all confirmatory fixed laboratory data. The U.S.EPA CLP SOWs delineate all of the pertinent analytical data deliverables which are to be provided by a laboratory performing these analyses. Therefore, cite that the analytical data deliverables acquired for a site-specific Brownfields investigation are to be generated in accordance with the appropriate U.S.EPA CLP SOW. For TCL determinations, specify the use of ***U.S.EPA Contract Laboratory Program Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration OLM0 4.2*** *or latest revision. For TAL determinations, specify the use of* ***U.S.EPA Contract Laboratory Program Statement of Work for Inorganics Analysis, Multi-Media, Multi-Concentration ILM0 4.0*** *or latest revision.*

N.4.2 In-situ Field Analytical Data Deliverable Requirements

To ensure in-situ field analytical screening data are of an appropriate quality, it is important to specify the necessary deliverables required to assemble a suitable data package. This will involve making considerations for the following prerequisites:

- *Sample documentation (recording sample collection location, time & date, and associated field measurements, etc.).*
- *Field analytical documentation (requiring raw data, calculations, and final results for the field screening analysis of all environmental and accompanying QC samples be provided).*

Therefore, in the Site-Specific Brownfields SAMP, describe the data deliverables required to document all pertinent in-situ field analytical screening determinations. This is imperative to enable Brownfields stakeholders to comprehend the data, and logically utilize it to formulate sensible environmental decisions. Likewise, the utilization of proper data reporting forms will ensure field measurement results are scientifically valid and legally defensible.

O.0 Quality Assurance Requirements

The data collection scheme put forward in this generic Brownfields QAPP boilerplate encourages the design of a monitoring network which blends in-situ field analytical screening techniques with confirmatory fixed laboratory analyses. It specifies that a minimum of 20% of all samples collected during a Brownfields site investigation undergo fixed laboratory U.S.EPA CLP TAL and TCL confirmatory analyses. In conjunction, it specifies that approximately 50% of all background or "presumed clean" reference samples should likewise undergo fixed laboratory U.S.EPA CLP TAL and TCL confirmatory analyses to limit false negative and sampling errors. Therefore, to ensure data are of an appropriate quality, the following protocols apply whenever duplicate samples are collected to confirm field screening and/or laboratory analyses with limited analytical deliverables:

- When applicable, rinse and trip blanks will be collected and analyzed with all environmental samples.
- When CLP methods are used to corroborate field sampling or laboratory data with limited analytical deliverables, additional method specific duplicate samples should **not** be analyzed.
- Protocols for these CLP confirmatory analytical methods, sample containers, data deliverables, preservatives, chain-of-custody forms, matrix spike sample volumes, and shipping requirements are derived from the ***U.S.EPA Sampler's Guide to the Contract Laboratory Program***.

O.1 Definitive Data Requirements

When conducting a Brownfields site investigation, definitive data should always be acquired using rigorous analytical protocols, such as conventional U.S.EPA reference methods. This involves securing the acquisition of data which are media-specific to confirm target analyte identities and concentrations. Conventional analytical methods are known to produce tangible raw data (chromatograms, spectra, digital values, etc.) in the form of paper printouts and/or computer-generated electronic files. In most instances, definitive data can be generated at the site with a field analytical screening technique or at an off-site fixed laboratory by employing the necessary QA/QC protocols. But regardless of what type of determination is utilized, for data to be definitive, an assessment of analytical or total measurement error must be determined. Therefore, the following criteria should always be implemented when performing a site-specific Brownfields investigation:

- Definitive data QA/QC elements.
- Sample documentation (location, date and time collected, batch, etc.).
- Chain of custody for samples analyzed by an off-site laboratory.
- Sampling design approach (systematic, simple or stratified random, judgmental, etc.).
- Initial and continuing calibration.
- Determination and documentation of instrument and method detection limits.
- Analyte(s) identification.
- Analyte(s) quantification.
- QC blanks (trip, method, rinsate).
- Matrix spike recoveries.

O.2 Analytical Error

Performing an estimate of analytical error is the process of determining a measure of overall precision for a particular analytical method. To render a determination of analytical error, an appropriate number of duplicate aliquots are taken from at least one thoroughly homogenized sample. These duplicate sample aliquots are then analyzed with standard laboratory QC parameters to calculate and compare method performance criteria (variance, mean, and coefficient of variation).

O.3 Total Measurement Error

The determination of total measurement error is an estimate of the overall precision of an environmental data acquisition system, from sample collection through analysis. To render a determination of total measurement error, an appropriate number of samples are independently collected from the same location. These co-located samples are then analyzed with standard laboratory QC parameters to calculate and assess measurement error goals (variance, mean, and coefficient of variation). Measurement error goals are acceptance/performance criteria typically established for the purpose of evaluating data quality. To ascertain a thorough assessment of total measurement error, this process should be undertaken for each environmental matrix under investigation and/or repeated for a given media at more than one location.

O.4 Assessment and Response Actions

In this section of the Site-Specific Brownfields SAMP, describe the procedures used to assess PARCC for every major measurement parameter, including all pollutant monitoring systems. This will include describing the statistical procedures for assessing the acceptance/performance criteria outlined for each measurement system utilized. These procedures must contain the equations required to calculate PARCC and method detection limits, as well as, the processes used to gather data for these calculations. The requirements of this element are usually met by integrating the appropriate statistical assessments depicted for data measurement QA objectives with the pertinent sample preparation and analytical procedures.

O.5 Correlation of Fixed Laboratory and In-situ Field Analytical Data

The data collection scheme put forward in this generic QAPP boilerplate specifies that at least 20% of all samples undergoing in-situ field analytical screening analysis be sent to a fixed laboratory for confirmation. In conjunction, approximately 50% of all background or "presumed clean" reference samples should likewise be sent to fixed laboratory for confirmation as well. These verifications are undertaken for the purpose of assessing the performance of in-situ field analytical screening techniques employed to acquire data. This is done to minimize the occurrence of acquiring false negative field analytical screening results (not detecting contamination) to assimilate an abstract estimation of data "worth."

Performing a comparison of in-situ field screening measurement data to fixed laboratory confirmatory results can be presented in a number of formats. These formats include log-log scatter plots, percent difference histograms, and formal performance assessment in light of established goals. These statistical assessments provide information to enable a decision maker to draw conclusions about the strength of evidence depicted by the collected measurement data. An outline for rendering one of these formal statistical determinations is described in the ***U.S.EPA Guidance for Data Quality Assessment: Practical Methods for Data Analysis*** [16]. *To facilitate these efforts, this U.S.EPA guide is provided as an attachment to this generic QAPP boilerplate.*

Therefore, in the Site-Specific Brownfields SAMP, describe the processes which will be employed for correlating field generated measurement data with its associated fixed laboratory confirmatory analytical results. To ensure these assessments are relevant and appropriate, it is advantageous to select and utilize one of the statistical approaches delineated in the U.S.EPA Data Quality Assessment guidance. In addition, it is essential that this summation include procedures for identifying and correcting any problems encountered as a result of these operations.

FORM P: PROJECT REPORTS

P.0 Quality Assurance Reporting

When conducting a Brownfields site investigation, it is essential to establish mechanisms for providing periodic reports on measurement system performance and data quality to management. These reports should always provide an assessment of measurement data in terms of PARCC, performance audit results, systems audit results, and significant QA problems along with any recommended solutions. In addition, it is prudent that these reports be prepared to include a separate QA section for the purpose of summarizing pertinent information on environmental measurement data quality.

P.1 Roles and Responsibilities

To ensure the successful outcome of any Brownfields site investigation project, it is integral for the environmental professional responsible for leading a municipality's remedial efforts to maintain close contact with the U.S.EPA Remedial Project Manager. This is necessary to ensure that pertinent information regarding the technical and financial progress of a site-specific Brownfields investigation is fully understood by all the parties which are involved. Customarily, this communication will begin upon the award of a U.S.EPA Brownfields pilot project grant. This will than necessitate the initiation of QA activities such as the development of project planning documentation.

P.2 Trip Reports

To provide a detailed accounting of what occurred during a particular sampling mobilization, trip reports are to be prepared for each site-specific Brownfields investigation. Traditionally, trip reports are to be completed within two weeks of the last day of each sampling mobilization. For the effective use of trip reports, it is important that they provide information in a timely manner by noting major events, dates, and personnel on-site (including affiliations). To facilitate these efforts, trip reports should be assembled as follows:

- Background.
- Observations and Activities.
- Conclusions and Recommendations (optional).
- Future Activities.

P.3 Project Report Requirements

In this section of the Site-Specific Brownfields SAMP, identify the frequency, content, and distribution of all reports detailing the status, internal assessment findings, implementation of corrective actions, and results for a given project. For example, the field team may be required to submit daily status reports comprised of field log sheets describing any field measurements taken, the number of samples collected with a summary of their status (shipped, at lab, or awaiting shipment), and/or deviations from SOPs. In addition, this summary must also delineate who will be responsible for preparing all reports to management along with a time line for preparation and distribution.

FORM Q-1: VERIFICATION OF SAMPLING PROCEDURES

Q-1.0 Performance and Systems Audits

When conducting a Brownfields site investigation it is integral to perform internal, as well as, external performance and systems audits. These audits are undertaken to evaluate the capability and performance of the total measurement system comprising a Brownfields environmental monitoring network. These oversight activities are useful in ensuring that field activities are providing samples reflective of the site and its conditions.

To evaluate the accuracy of the total measurement system or component thereof, performance audits are usually undertaken periodically to assess data collection efforts. In regard to field sampling operations, this oversight function is performed to critique in-situ monitoring efforts and sample collection activities. However, for performance audits to be effective, they should be scheduled in accordance with the applicable field operations warranting oversight.

Alternately, a systems audit focuses on evaluating the principal components of a measurement system to determine proper selection and use. In regard to field sampling operations, this oversight activity is performed to critique the quality control procedures which are to be employed. Systems audits of this nature are to be performed periodically, prior to or shortly after, field operations commence until the project is completed.

Q-1.1 Verification of Sampling Procedures

In this section of the Site-Specific Brownfields SAMP, describe the processes for reviewing all sampling procedures to ensure they are consistent with the proposed sampling network and rationale.

FORM Q-2: DATA VERIFICATION AND VALIDATION

Q-2.0 Data Validation

To ensure that the measurement data acquired when preforming a Brownfields site investigation are of an appropriate quality, it is important to specify and follow procedures for validating all pertinent environmental monitoring results. Data validation is regarded as a systematic process for reviewing a body of results against a set of established criteria to provide a specified level of assurance concerning validity. It requires a systematic and uniform evaluation to be performed on the data to identify those results with questionable quantitative value.

The approach for performing data validation should always be independent of the data production effort, and objective in its application. In most instances, the criteria for validating data will include conducting checks for internal consistency, reviews for transmittal errors, and/or audits for verifying laboratory capability. This will typically involve interpreting the results of external performance audits such as split sample, duplicate sample (field and laboratory), spiked sample, and initial calibration determinations. In conjunction, the assessment of detection limit studies, intra-laboratory comparisons, inter-laboratory comparisons, tests for normality, tests for outliers, and data base entry checks may also be undertaken.

Q-2.1 Data Verification and Validation Requirements

In this section of the Site-Specific Brownfields SAMP, describe the processes that will be used to validate and document the quality of the analytical data which are acquired. In addition, delineate the processes for assessing if the analytical data are adequate based upon predefined acceptance/performance criteria for meeting the needs of the Brownfields site investigation. It is important to note that all pertinent measurement results acquired through fixed laboratory or in-situ screening analyses must undergo data validation.

Q-2.1.1 Fixed Laboratory Confirmatory Data Verification and Validation Requirements

*The project objectives and acceptance/performance criteria put forward in this generic QAPP boilerplate specify the use of our U.S.EPA CLP SOWs for acquiring all fixed laboratory confirmation data. The U.S.EPA CLP SOWs delineate the analytical determinations, QC requirements, and data deliverables for performing these analyses. In accordance, U.S.EPA Region 2 has developed standardized protocols for validating CLP analyses. As a result, the corresponding U.S.EPA Region 2 data validation protocols are practical for validating confirmatory Brownfields site investigation data. To expedite these efforts, the corresponding U.S.EPA Region 2 CLP data validation protocols (**SOP No. HW-6: CLP Organics Data Review and Preliminary Review** [17] and **SOP No. HW-2: Evaluation of Metals Data for the Contract Laboratory Program** [18]) are included as attachments to this generic QAPP boilerplate.*

Q-2.1.2 <u>In-situ Field Analytical Data Verification and Validation Requirements</u>

To ensure in-situ field analytical screening data are of an appropriate quality, QA/QC protocols for ascertaining precision and accuracy are to be prescribed when performing such analyses. These optional QA/QC protocols should include, but are not limited to, the following requirements:

- *Sample documentation (recording sample collection location, time & date, and associated field measurements, etc.).*
- *Field analytical screening documentation (providing raw data, calculations, and final results for the field screening analysis of all environmental and accompanying QC samples).*
- *Method calibration (requiring the initial and continuing calibration of all field analytical instrumentation according to the instrument manufacturer's operating instructions).*
- *Method blank analysis (requiring that a volume of deionized, distilled laboratory water be carried through the entire analytical sequence with every sample delivery group to check on the occurrence of contamination resulting from sample preparation and measurement activities).*
- *Duplicate sample analysis (requiring the analysis of a duplicate environmental sample with every sample delivery group to document method reproducibility).*
- *Fixed laboratory confirmation analysis (requiring that a portion of all environmental samples analyzed with a field analytical screening technique undergo fixed laboratory quantitation to document method performance).*
- *Method control sample analysis (requiring the analysis of a pre-prepared sample spiked at the action level with every sample delivery group to document method performance).*
- *Matrix spike analysis (requiring the analysis of an environmental sample spiked with a target analyte(s) of concern with every sample delivery group to assess matrix effects).*
- *Continuing calibration verification analysis (requiring the analysis of a known standard every 10 samples to check the accuracy of a measurement process).*

In-situ field analytical screening results and measurement data with limited deliverables should always be validated by assessing the quality control requirements designated for each respective technique. Therefore, in the Site-Specific Brownfields SAMP, describe the processes for validating the quality and usability of such data utilizing prescribed QA/QC protocols. To facilitate these efforts, it is advantageous to follow the U.S.EPA Region 2 CLP data validation SOPs included in this generic QAPP boilerplate as a basis for rendering these assessments. This is done by applying the criteria pertinent to the evaluation of an applicable QC sample audit assessment. This will enable a data user to comprehend the uncertainty evident in this data, and logically utilize that data to formulate sensible environmental decisions. In doing so, this will ensure that all resulting field measurement screening data are scientifically valid, and legally defensible.

R.0 Data Quality Assessment

When performing a Brownfields site investigation, it is essential to correlate validated measurement data for reconciliation with the acceptance/performance criteria specified for the project. This will involve rendering a determination to ascertain whether measurement data are of the right type, quality, and quantity required to support environmental decision making efforts. To perform this activity, scientific and statistical procedures must be employed to provide an assessment.

The technique for determining if validated measurement results are adequate for their intended use is known as the Data Quality Assessment (DQA) process. The DQA process can provide information to enable a decision maker to draw conclusions about the strength of evidence depicted by a set of collected measurement data. To assist in these efforts, an outline of the formal DQA process is described in the ***U.S.EPA Guidance for Data Quality Assessment: Practical Methods for Data Analysis.*** As previously noted, this guide is included as an attachment to this generic QAPP boilerplate.

R.1 Data Quality Assessment Process

The DQA process is both a scientific and statistical evaluation technique which consists of the following five steps:

- Review project acceptance/performance criteria and sampling design.
- Conduct a preliminary data review.
- Select a statistical test (i.e., Shaprio-Wilk W test, Student's t-Test, etc.).
- Verify the assumptions of the selected statistical test.
- Draw conclusions from the data.

Even if the formal DQA process is not followed in its entirety, a systematic assessment of measurement data quality should always be performed when conducting a Brownfields site investigation. This systematic process will involve carrying out the following data assessments:

- Validating all pertinent measurement data for scientific anomalies.
- Correlating all pertinent measurement data to the PARCC parameters designated for the project.
- Identifying measurement data trends and outliers.

In doing so, one can assimilate an abstract estimation of data "worth" to provide Brownfields stakeholders with a rationale for making proper decisions.

R.2 Data Usability/Reconciliation Requirements

In the section of the Site-Specific Brownfields SAMP, describe the processes for determining whether all pertinent environmental measurement data successfully meet the requirements specified for their intended use. It is important that this summary include an outline of the methods which will be used to identify anomalies and departures from the assumptions delineated in the sampling and analysis design. In

addition, it is integral to describe how any environmental measurement data limitations which are found to be evident will be reported.

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ATTACHMENT 1

Glossary of Terms

Accuracy A measure of the closeness of an individual measurement or the average of a number of measurements to the true value. Accuracy is influenced by a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations. EPA recommends that this term not be used and that precision and bias be used to convey the information usually associated with accuracy.

Analyte The chemical compound or element for which a sample is analyzed.

ARARs Applicable or Relevant and Appropriate Requirements.

ASTM American Society of Testing and Materials - An organization which develops and publishes standard methods of analysis and standards for materials and procedures.

Background A level of hazardous substances that approximates the level that would be present in the medium of concern if the source of contamination under analysis did not exist.

Bias The systematic or persistent distortion of a measurement process which causes errors in one direction (i.e., the expected sample measurement is different from the sample's true value). Bias can result from improper data collection, poorly calibrated analytical or sampling equipment, or limitations or errors in analytical methods and techniques.

Bioaccumulation The tendency of a hazardous substance to be taken up and accumulated in the tissue of organisms, either directly through consumption of food containing the hazardous substance. Bioaccumulation typically results in increasing concentrations of hazardous substances in tissues of organisms higher up in the food chain.

Blank A sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage, or analysis. The blank is subjected to the same analytical or measurement process as other samples to the same analytical or measurement process as other samples to establish a zero baseline value and is sometimes used to adjust or correct routine analytical results.

Brownfields Site Manager Person appointed by the cooperative agreement recipient or lead agency to oversee cleanups at specific sites.

Calibration Comparison of a measurement standard, instrument, or item with a standard or instrument of higher accuracy to detect and quantify inaccuracies ad to report or eliminate those inaccuracies by adjustments.

Calibration Standards prepared by successive dilution of a standard solution covering the full

Standard concentration range required and expected to be seen in the samples, for the organic and inorganic analytical method. The calibration standard must be prepared using the same type of acid or solvent used to prepare samples for analysis.

CERCLA Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended.

Chain -of-Custody An unbroken trail of accountability that ensures the physical security of samples, data, and records.

CLP U. S. EPA's Contract Laboratory Program. Refers to laboratory specifications, analytical methods, and QA/QC protocols required for Superfund and related activities.

Co-located Samples Independent samples collected in such a manner that they are equally representative of the parameter(s) of interest at a given point in space and time.

Comparability The confidence with which one data set can be compared to another.

Completeness A measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct, normal conditions.

Composite Sample Non-discrete samples composed of one or more individual samples taken at different locations at a site. Composite samples are representative of the average concentrations of contaminants across a large area.

Control Sample A QC sample introduced into a data collection process to monitor the performance of the system.

Cooperative Agreement A form of assistance provided by a Federal agency in which a substantial interaction is anticipated between the Federal agency and the assistance recipient (e.g., State, Tribal, Commonwealth, or local government or other) during the performance of the contemplated activity.

Data Validation Confirmation through examination and provision of objective evidence that requirements for a specific intended use have been met. The process of examining the analytical data to determine conformance to user needs.

Data Verification Confirmation through examination and provision of objective evidence that predefined requirements for a specific intended use have been met. The process of examining the result of a given activity to verify conformance to stated requirements for that activity.

Definitive Data Data that are documented as appropriate for rigorous uses that require both hazardous substance identification and concentration. Definitive data are often used to quantify the types and extent of releases of hazardous substances. *Guidance for Performing Site Inspections Under CERCLA, Interim Final, p.99; Guidance for Data Usability in Site Assessment, Draft, pp.13 and 14.*

DL Detection limit - the lowest concentration or amount of the target analyte that can be determined to be different from zero by a single measurement at a stated level of probability.

Duplicate Sample A second sample taken from and representative of the same population and carried through all steps of the sampling and/or analytical procedures in an identical manner. See Field Duplicate, Matrix Duplicate, and Matrix Spike Duplicate.

DQOs Data Quality Objectives - Qualitative and quantitative statements (derived from the DQO process) that clarify the objectives of studies, technical processes and quality assurance programs, define the appropriate type, and specify tolerable levels of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support decisions.

Equipment Blank Also called the equipment Rinsate. A sample of analyte-free reagent taken after completion of decontamination and prior to sampling at the next sample location. It is used to check field decontamination procedures to ensure that analytes from one sample location have not contaminated a sample from the next location.

False Positive Decision Error The erroneous decision that the null hypothesis is correct.

False Negative Decision Error The erroneous decision that the null hypothesis is incorrect.

Field Blank A blank used to provide information about contaminants that may be introduced during sample collection, storage, and transport. A clean sample, carried to the sampling site, exposed to sampling conditions, and returned to the laboratory and treated as an environmental sample.

Field Duplicate An independent sample collected from the same location or source, as close as possible to the same point in space and time. Duplicates are stored in separate containers and analyzed separately for the purpose of documenting the precision of the sampling process. (Laboratory variability will also be introduced into the samples' results.)

GC Gas Chromatography - An analytical technique used to analyze environmental matrices for organic contaminants.

GC/MS Gas chromatography/Mass Spectrometry - This is a gas chromatography analyzer combined with a mass spectrometer detector. The mass spectrometer uses the difference in mass-to-charge ratio (m/e) of ionized atoms or molecules to separate them from each other and to quantify their concentrations.

Grab Samples Discrete samples that are representative of a specific area and a specific time. Useful in identifying "hot spots" of contamination at a site.

Hazardous CERCLA hazardous substances, pollutants, and contaminants, as defined in

CERCLA Substances Sections 101(14) and 101(33).

Holding Time The period a sample may be stored prior to its required analysis. Although exceeding the holding time does not necessarily negate the veracity of analytical results, it causes the qualifying or "flagging" of the data for not meeting all of the specified acceptance criteria.

Human Exposure Any exposure of humans to a release of one or more hazardous substances via inhalation, ingestion, or dermal contact. *Amdur, Mary O., John Doull, and Curtis D./ Klaassen, toxicology, The Basic Science of Poisons, Forth Edition, 1991, p.14; Hazard Ranking System guidance Manual, Interim Final, pp. 153. 259, 293, 317, 363, and 411.*

Interference An element, compound, or other matrix effect present in a sample which interferes with detection of a target analyte leading to inaccurate concentration results for the target analyte.

Matrix The substrate containing the analyte of interest - examples are soil, water, sediments, and air. Also called medium or media.

Matrix Duplicate A duplicate field sample used to document the precision of sampling and homogeneity of a given sample matrix. (Sample as field duplicate.)

Matrix Spike (MS) A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. Spiked samples are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

Matrix Spike Duplicate (MSD) A split sample, both portions of which are spiked with identical concentrations of target analytes, for the purpose of determining the bias and precision of a method in a particular sample matrix.

Maximum Contaminant Level (MCL) Maximum concentration of a contaminant allowed in drinking water systems by the National Primary Drinking Water Regulations; 40 CFR 141.11 (inorganic chemicals) and 141.12 (organic chemicals).

Method Blank A clean sample processed simultaneously with and under the same conditions as samples containing an analyte of interest through all steps of the analytical procedure.

Method Detection Limit (MDL) The minimum concentration of an analyte that can be measured and reported with 99% confidence. It is determined by analysis of samples with known concentrations at various dilutions. This limit is matrix-specific (e.g., soils vs. waters).

Municipality An urban political unit with corporate status and usually powers of self-government.

Null Hypothesis Presumed or baseline condition. In the case of environmental investigations, generally either that the site is contaminated or that the site is clean.

ppb Parts Per Billion; Fg/kg (micrograms per kilogram); Fg/l (micrograms per liter).

ppm Parts Per Million; mg/kg (milligrams per kilogram); mg/l (milligrams per liter).

Precision A measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions, expressed generally in terms of the standard deviation.

Priority Pollutants List of inorganic and organic analytes commonly tested for in the National Pollution Discharge Elimination System (NPDES) program.

QA Quality Assurance - An integrated system of management activities involving planning, implementation, assessment, reporting, and quality improvement to ensure that a process, item or service is of the type and quality needed and expected.

QAPP Quality Assurance Project Plan - A formal document describing in comprehensive detail the necessary QA, QC, and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria.

QC Quality Control - The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer; operational techniques and activities that are used to fulfill requirements for quality.

QL Quantitation Limit - The level above which quantitative results may be obtained with a specified degree of confidence.

RCRA The Resource Conservation and Recovery Act of 1976, as amended.

Release Any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment (including the abandonment or discharging of barrels, containers, and other closed receptacles containing any hazardous substance or pollutant or contaminant). CERCLA 101(22)

Representativeness A measure of the degree to which the measured results accurately reflect the medium being sampled. It is a qualitative parameter that is addressed through the design of the sampling program in terms of sample location, number of samples, and the actual material collected as a “sample” of the whole.

SAMP Sampling Analysis and Monitoring Plan (SAMP) - Site and event specific plan detailing sampling rationale, protocols, and analyses planned per sample type. A part of the QAPP.

Sample Delivery Group A Sampling Delivery Group (SDG) is defined as being either a Case of environmental field samples received for analysis, each twenty (20) environmental field samples within a Case received for analysis, or each fourteen (14) calendar day period which environmental field samples in a Case are received for analysis, whichever is most frequent.

Screening Data Data that are appropriate for applications that only require determination of gross contamination areas and/or for site characterization decisions that do not require quantitative data. Screening data are often used to specify which areas to sample to collect definitive data. *Guidance for Performing Site Inspections Under CERCLA, Interim Final, pp.99 and 100; Guidance for Data Usability in Site Assessment, Draft p. 15.*

SOP Standard operating procedure - A written document that details the method for an operation, analysis, or action with thoroughly prescribed techniques and steps, and that is officially approved as the method for performing certain routine or repetitive tasks.

Source Area An area of contamination from which substances may have migrated to other media. Several source areas can be located within a site.

Spike A known quantity of a chemical that is added to a sample for the purpose of determining (1) the concentration of an analyte by the method of standard additions, or (2) analytical recovery efficiency, based on sample matrix effects and analytical methodology. Also called analytical spike.

Split Samples two or more representative portions taken from one sample in the field or in the laboratory and analyzed and analyzed by different analysts or laboratories. Split samples are used to duplicate the measurement of the variable(s) of interest.

Standard Addition The practice of adding a known amount of an analyte to a sample immediately prior to analysis used to evaluate interferences.

Standard Curve A plot of concentrations of known analyte standards versus the instrument response to the analyte.

Surrogate A pure substance with properties that mimic the analyte of interest. It is unlikely to be found in environmental samples and is added to them to establish that the analytical method has been performed properly.

SVOA Semi-Volatile Organic Analysis or Analyte.

SVOC Semi-Volatile Organic Compound. BNA; extractable organic compound.

SW-846 U. S. EPA "Test Methods for Evaluating Solid Waste," 1986 (Third Edition), plus Updates, a publication describing standard methods of analysis, sampling techniques, and QA/QC procedures.

TBC To Be Considered.

Trip Blank A clean sample of matrix that is carried to the sampling site and transported to the laboratory for analysis without having been exposed to sampling procedures.

VOA Volatile Organic Analysis or Analyte.

VOC Volatile Organic Compound.